FORM PTO-1390 (REV. 5-93)	U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE	ATTORNEY'S DOCKET NUMBER 10191/1964

TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371

U.S. APPLICATION NO. (If known, see 37 CFR 1.5)
09/913470

INTERNATIONAL APPLICATION NO.	INTERNATIONAL FILING DATE	PRIORITY DATE(S) CLAIMED
PCT/DE00/00374	(08.02.00) 8 February 2000	(19.02.99) 19 February 1999

TITLE OF INVENTION
A METHOD FOR THE CONNECTION-ORIENTED TRANSMISSION OF DATA PACKETS

APPLICANT(S) FOR DO/EO/US

VOLLMER, Vasco; RADIMIRSCH, Markus; and SEIDEL, Guenter

Applicant(s) herewith submit to the United States Designated/Elected Office (DO/EO/US) the following items and other information

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. ☒ This is an express request to begin national examination procedures (35 U.S.C. 371(f)) immediately rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(1).
4. ☒ A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.
5. ☒ A copy of the International Application as filed (35 U.S.C. 371(c)(2))
   a. ☐ is transmitted herewith (required only if not transmitted by the International Bureau).
   b. ☒ has been transmitted by the International Bureau.
   c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US)
6. ☒ A translation of the International Application into English (35 U.S.C. 371(c)(2)).
7. ☒ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3))
   a. ☐ are transmitted herewith (required only if not transmitted by the International Bureau).
   b. ☐ have been transmitted by the International Bureau.
   c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
   d. ☒ have not been made and will not be made.
8. ☐ A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
9. ☒ An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)) (unsigned).
10. ☒ A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

Items 11. to 16. below concern other document(s) or information included:

11. ☒ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
12. ☐ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
13. ☒ A **FIRST** preliminary amendment.
    ☐ A **SECOND** or **SUBSEQUENT** preliminary amendment.
14. ☒ A substitute specification and a marked up version thereof.
15. ☐ A change of power of attorney and/or address letter.
16. ☒ Other items or information: International Search Report (translated), International Preliminary Examination Report (translated), and Form PCT/RO/101.

Express Mail No. EL244503761US

533 Rec'd PCT/PTO 15 AUG 2001

U.S. APPLICATION NO. if known, see 37 C.F.R.1.5	INTERNATIONAL APPLICATION NO.	ATTORNEY'S DOCKET NUMBER
09/913470	PCT/DE00/00374	10191/1964

17. ☒ The following fees are submitted:	CALCULATIONS	PTO USE ONLY
Basic National Fee (37 CFR 1.492(a)(1)-(5)): Search Report has been prepared by the EPO or JPO $860.00		
International preliminary examination fee paid to USPTO (37 CFR 1.482) . . . $690.00		
No international preliminary examination fee paid to USPTO (37 CFR 1.482) but international search fee paid to USPTO (37 CFR 1.445(a)(2)) $710.00		
Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO $1000.00		
International preliminary examination fee paid to USPTO (37 CFR 1.482) and all claims satisfied provisions of PCT Article 33(2)-(4) $100.00		
ENTER APPROPRIATE BASIC FEE AMOUNT =	$ 860	
Surcharge of $130.00 for furnishing the oath or declaration later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492(e)).	$	

Claims	Number Filed	Number Extra	Rate		
Total Claims	10 - 20 =	0	X $18.00	$	
Independent Claims	1 - 3 =	0	X $80.00	$	
Multiple dependent claim(s) (if applicable)			+ $270.00	$	
TOTAL OF ABOVE CALCULATIONS =				$860	
Reduction by 1/2 for filing by small entity, if applicable. Verified Small Entity statement must also be filed. (Note 37 CFR 1.9, 1.27, 1.28).				$	
SUBTOTAL =				$860	
Processing fee of $130.00 for furnishing the English translation later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492(f)). +				$	
TOTAL NATIONAL FEE =				$860	
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). $40.00 per property +				$	
TOTAL FEES ENCLOSED =				$860	
				Amount to be: refunded	$
				charged	$

a. ☐ A check in the amount of $_____ to cover the above fees is enclosed.

b. ☒ Please charge my Deposit Account No. 11-0600 in the amount of $860.00 to cover the above fees. A duplicate copy of this sheet is enclosed.

c. ☒ The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. 11-0600. A duplicate copy of this sheet is enclosed.

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO:

By Reg No 35,952

SIGNATURE

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NAME

8/15/01
DATE

397346

[10191/1964]

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant(s)	:	Vasco VOLLMER et al.
Serial No.	:	To Be Assigned
Filed	:	Herewith
For	:	A METHOD FOR THE CONNECTION-ORIENTED TRANSMISSON OF DATA PACKETS
Art Unit	:	To Be Assigned
Examiner	:	To Be Assigned

Assistant Commissioner
for Patents
Washington, D.C. 20231

PRELIMINARY AMENDMENT AND
37 C.F.R. § 1.125 SUBSTITUTE SPECIFICATION STATEMENT

SIR:

Please amend the above-identified application before examination, as set forth below.

IN THE TITLE:

Please replace the title with the following:

--A METHOD FOR THE CONNECTION-ORIENTED TRANSMISSION OF DATA PACKETS--.

IN THE SPECIFICATION AND ABSTRACT:

In accordance with 37 C.F.R. § 1.121(b)(3), a Substitute Specification(including the Abstract, but without claims) accompanies this response. It is respectfully requested that the Substitute Specification (including Abstract) be entered to replace the Specification of record.

IN THE CLAIMS:

Please cancel claims 1-10 in the underlying PCT application, without prejudice.

Please also cancel claims 1-10 in the annex to the International Preliminary Examination Report, without prejudice.

Please add the following new claims:

11. (New) A method for transmitting data packets in a communications system in a frame-oriented form between a master station and a plurality of subscribers, comprising:

exchanging useful data packets and control data packets between the master station and the subscribers, at least one of the useful data packets and the control data packets being stored in containers within a transmission frame;

storing an identifier in an information element within each of the containers within the transmission frame to identify a virtual connection to which at least of one the useful data packets belongs, the identifier indicating the connection to which at least one of the containers for user data packets transmitted by one of the subscribers to the master station belongs; and

freely dividing by the one of the subscribers a capacity allocated to the one of the subscribers by the master station among user data packets and control data packet.

12. (New) The method according to claim 11, wherein the storing step includes storing the identifier within at least one of the control data packets.

13. (New) The method according to claim 11, further comprising:

transmitting the identifier in the information element, the information element including at least connection identifiers for subsequent containers for useful data packets of one connection.

14. (New) The method according to claim 11, wherein the storing step includes storing the information element as two fields for the virtual connection, a first field for a connection identifier, and a second field for a number of subsequent containers for user data packets for the virtual connection.

15. (New) The method according to claim 11, wherein the storing step includes storing one connection identifier in the information element for every container for useful data packets.

16. (New) The method according to claim 11, wherein the storing step includes storing in a header of the information element a type of fields contained in the information element.

17. (New) The method according to claim 11, wherein the storing step includes storing in the information element a length of the information element.

18. (New) The method according to claim 11, wherein the storing step includes storing in the information element a field indicating for two other fields whether the two other fields specify: one connection ID and for a number of useful data packets for the one connection ID, or two connection IDs.

19. (New) The method according to claim 11, wherein a connection between the master station and the one of the subscribers stipulates whether containers for useful data packets in the transmission frame are filled with a plurality of control data packets.

20. (New) The method according to claim 11, further comprising:

allocating terminal resources per subscriber or per subscriber terminal, the subscriber or subscriber terminal selecting the useful data packets of different connections.

Remarks

This Preliminary Amendment cancels, without prejudice, claims 1-10 in the underlying PCT Application No. PCT/DE00/00374. This Preliminary Amendment also cancels, without prejudice, claims 1-10 in the annex of the International Preliminary Examination Report, and adds new claims 11-20. The new claims conform the claims to the U.S. Patent and Trademark Office rules and do not add new matter to the application.

The amendments to the specification and abstract reflected in the substitute specification are to conform the specification and abstract to U.S. Patent and Trademark Office rules, and do not introduce new matter into the application.

The underlying PCT Application No. PCT/DE00/00374 includes an International Search Report, issued July 27, 2000, a copy of which is included. The Search Report includes a list of documents that were considered by the Examiner in the underlying PCT application.

The underlying PCT Application No. PCT/DE00/00374 also includes an International Preliminary Examination Report, issued May 14, 2001. A translation of the International Preliminary Examination Report and annex thereto is included herewith.

It is respectfully submitted that the present invention is new, non-obvious, and useful. Prompt consideration and allowance of the claims are respectfully requested.

Respectfully Submitted,

KENYON & KENYON

By: Reg No 35,952

Dated: 8/15/01

By: _____

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A METHOD FOR THE CONNECTION-ORIENTED TRANSMISSION OF DATA PACKETS

FIELD OF THE INVENTION

The present invention relates to a method for transmitting data packets in a communications system in a frame-oriented form between a master station and a plurality of subscribers. Specifically, useful data packets and control data packets are exchanged between the master station and the subscribers.

BACKGROUND INFORMATION

In centrally controlled communications networks, e.g., in a centrally controlled wireless cellular network according to the HYPERLAN type 2 ETSI Project, a central unit ZE is provided to which a plurality of terminals can be connected (see Figure 1). This wireless network functions in a connection-oriented manner, i.e., at least one connection must be established before data can be exchanged with other subscribers or their terminals, which are connected to the network or to master station ZE. On the basis of subscriber demands, the master station assigns the terminals the data rate they need on the shared medium. It is possible for one terminal of one subscriber to have more than one active virtual connection at the same time, as is the case with ATM. In an implementation form of this network, the resource requests by the terminals as well as the resource allocations (resource grants) by master station ZE are carried out per connection, i.e., the terminal transmits the amount of data packets that need to be transmitted for each of its connections. Providing data rates during which data can be transmitted on the medium is considered a resource here. Accordingly, master station ZE transmits a resource allocation for each connection of terminal T. In the case of the resource allocation per connection, the assignment of a transmitted data packet to a connection is explicitly provided by the

allocation of master station ZE. Thus, this information is already present in master station ZE and does not need to be additionally transmitted by the terminal.

In the aforementioned wireless network, two different data packet sizes are provided for the data to be transmitted. In this context, short packets (approximately 6 bytes; short data container: KD) are used for transmitting control information, i.e., information that is not useful data but is used to control and manage the network, e.g., to establish connections, to associate terminals, to carry out handovers, or to re-request incorrectly received data packets, for example. Long data containers LD have a length of about 54 bytes and are normally used for transmitting useful data. In addition to pure useful data, further information is included that is closely related to the useful data, e.g. a sequence number or a checksum for error detection.

A transmission in the downlink direction (master station toward the subscriber) as well as in the uplink direction (terminal toward the master station) includes a plurality of control data packets KD at the beginning and a subsequent plurality of useful data packets LD according to Figure 2. The exact number of control data packets KD and useful data packets LD is determined by master station ZE in the resource allocation.

A method for transmitting in a communications system in a frame-oriented form between a master station and a plurality of subscribers is described in Raychaudhuri D. et al., "WATM net: A Prototype Wireless ATM System for Multimedia Personal Communication," IEFE International Conference on Communications (ICC), U.S. New York, IEFE, June 23, 1996 (1996-06-23), pages 469-477. In this instance, useful data packets and control data packets are exchanged. An identifier is stored in the header of a data cell, for transmitting in a connection-oriented manner.

SUMMARY OF THE INVENTION

The measures make it possible, particularly in the case of a resource allocation per subscriber or per subscriber terminal, to give the master station preliminary information as to which connection of the subscriber or terminal a received data packet belongs to. This also applies for a resource request or resource allocation per traffic class, as discussed in detail in D. Petras, "Entwicklung und Leistungsbewertung einer ATM-Funkschnittstelle" (Development and Performance Evaluation of a Wireless ATM Interface) Dissertation at the RWTH Aachen, Aachen 1998, chapter 8.2, DynPara-PDU, and in the major points in D. Petras, U. Vornefeld, "Joint Performance of DSA++MAC Protocol for wireless ATM under realistic traffic and channel models", wmATM'98, Hangzhou, China 1998, chapter 4.

By storing the identifier, which indicates to which connection containers for useful data packets transmitted by the subscriber belong, in the transmission frame, it is possible to clearly identify data packets, which, themselves, do not include any information regarding the connection.

The identifier can advantageously be stored in already existing control data packets. In this manner, the result is a flexible method that does not need to change currently existing data formats. The identifier may also be divided up among a plurality of control data packets.

When containers for useful data packets are each filled with a plurality of control data packets due to a declaration (agreement) between the master station and the subscribers, the method can be easily integrated. The result is a flexible data structure that may be easily integrated in existing or future transmission standards.

The method is also useful in a communications system in which transmission resources are allocated per subscriber and the

subscriber or the subscriber terminal itself selects the useful data packets of different connections.

The application of the method may be particularly useful when a terminal has a large number of connections.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 shows a master station connected to a network and wirelessly connected to terminals.

Figure 2 shows an exemplary embodiment of a set of control packets and useful data products.

Figures 3 and 4 show the structure of the information elements.

Figure 5 shows the allocation of containers for useful data packets to a terminal.

Figures 6 through 13 show formats of further information elements.

Figure 14 shows containers for useful data packets being filled with control data packets.

DETAILED DESCRIPTION

In the HYPERLAN type 2 communications network indicated at the outset, there are two different types of data containers having different capacities. Data packets having a length of approximately 6 bytes typically contain control information. In the following, they are referred to as control data packets KD. Data packets having a length of about 54 bytes, i.e. having a data capacity of a multiple of the aforementioned data packets, contain, in addition to the useful data, only a short header field containing data belonging directly to the container contents, e.g. sequence number and error correction

bits. These data packets are referred to as useful data packets LD in the following. Useful data packets LD and control data packets KD are exchanged between a master station ZE and subscriber terminals T, a frame-oriented transmission being used (Figure 1).

A terminal requests a certain number of useful data packets LD and a certain number of control data packets KD from master station ZE. It is also possible that only useful data packets LD are requested, and control data packets KD are then automatically provided by master station ZE. This request may occur on the basis of the terminal's internal calculations regarding the needed capacity. Instead, a request per connection or per connection class is also possible. The information which relates to which virtual connection a useful data packet LD transmitted from the terminal belongs to is missing in master station ZE. In the method according to the present invention, this information is transmitted via an identifier CID (connection ID) in an information element IE. Since this information is control information, information element IE is advantageously stored in a control data packet KD within the transmission frame.

These information elements IE contain the information regarding the connection belonging to a useful data packet LD in the form of a connection identity number CID (connection ID). This ID already exists in the HYPERLAN type 2 system. In addition to the connection ID, the number of useful data packets LD for this connection must be transmitted. Another solution that can be used as an alternative or simultaneously is the transmission of the connection ID for every subsequent useful data packet LD, i.e., if a plurality of useful data packets LD belongs to one connection, the connection ID is transmitted several times. The second possibility is particularly suitable for connections having two or less useful data packets LD, since in this case, the field for the number of useful data packets LD is not needed. For the

implementation, it is particularly advantageous when both possibilities are available and either one possibility is definitively selected by the terminal at a certain instant, or the terminal selects the most favorable method from case to case, i.e., the method that generates the least amount of data. Both information elements IE then have a fundamental structure, as shown in Figures 3 and 4. The differentiation between the two types of information elements can occur, for example, as a result of different identifiers for information element IE (IE type) preferably in the header field. However, it is also possible to use the same identifier with an additional qualifier bit.

In the following exemplary embodiment, several parameters are used such that they correspond to the current state of the HYPERLAN type 2 communications network. In this context, two methods are described. The first method includes in each case two fields in information element IE for every active, virtual connection. In this context, the first field includes the identifier of the connection (connection ID), and the second field includes the number of subsequent useful data packets LD for this connection. The second method, on the other hand, only uses fields having connection IDs. In this case, the appropriate connection ID is transmitted for each subsequent useful data packet LD, i.e., when two useful data packets LD are transmitted for one connection, the list also shows the same connection ID twice.

For this example, a centrally controlled communications network having one or more connected terminals is given, as shown in Figure 1. For this example, it is assumed that there is a terminal having 5 virtual connections via master station ZE to the network (connection IDs 1 through 5). For these connections, the terminal transmits a data rate request for all connections. On the basis of this request, master station ZE assigns a certain data set to the terminal. The terminal can now freely use this assigned capacity. Ten allocated

useful data packets LD are accepted for the terminal. They are distributed by the terminal in accordance with Figure 5.

In this context, 32 bits are assumed as the smallest unit for a control data packet KD. For this reason, information elements IE should also have a granularity of 32 bits in order to efficiently pack them into a container for control data packets KD. At this point, the 6 bytes indicated above are dispensed with since only the error protection CRC, which is not important for these considerations, is in the remaining 2 bytes. 6 bits are assumed for the length of the connection ID and also for the field having the number of useful data packets LD. The result is the image shown in Figures 6 and 7 for the information elements according to the first method, i.e., for every connection for which data are transmitted, the connection ID as well as the number of useful data packets LD are transmitted. In this context, the field ID type having a value of 1 indicates that fields are allocated, as previously shown. The length of information element IE indicates how many of the 32 bit units are used (here = 2).

The example according to the second method uses the same fundamental parameters, however, only with 6 allocated useful data packets LD, which are distributed by the terminal in accordance with Figure 8. The result for the entire information element is the arrangement according to Figures 9 and 10. The IE type field having a value of 2 indicates the identification by useful data packet. In this case, in contrast to the first method, there is an efficient implementation of the information transmission provided that only a few useful data packets LD exist per connection.

A combination of the two methods is possible by means of the start of a new information element, which then in each case uses the other method. For this purpose, as an example, one starts out from the distribution of useful data packets LD shown in Figure 11. This total of 13 useful data packets LD

can be most efficiently addressed as shown in Figures 12 and 13. An additional possibility is to add a further short field that specifies in each case for two 6-bit fields whether they are used for one connection ID and for the number of useful data packets LD (first method), or for two connection IDs (second method).

In particular, in the event that a subscriber or a subscriber terminal T wishes to transmit urgent control information, terminal T is given the opportunity in accordance with the present invention to fill a container for useful data packets LD with a plurality of control data packets KD. However, for this purpose, information regarding the contents of a subsequent container for useful data must be stored in one control data packet. Moreover, information must be included as to which of the subsequent containers for useful data packets is meant. This is represented by an arrow in Figure 14: a container for useful data packets LD is filled with nine control data packets KD in the transmission frame. However, for this purpose, it must be known to master station ZE that the container is a normal container with useful data. For this purpose, according to the present invention, a declaration is made between master station ZE and a subscriber T that containers for useful data packets LD are filled with control data packets KD that are transmitted together, and it is determined which containers for useful data packets in the transmission frame are filled in each case with control data packets KD. In this context, there are different ways to make this declaration:

1. by a terminal announcing this in a previous control data packet KD. This procedure presupposes an evaluation of control data packets KD prior to the evaluation of useful data packets LD;
2. by announcing the mode in the header field of a useful data packet LD;

3. by transmitting a request by terminal T to master station ZE to be able to fill a container for useful data packets with control data packets;

4. by establishing a firm declaration that starting from a certain number of requests for control data packets KD by a terminal T, a container for useful data packets LD is instead assigned by master station ZE to be filled with control data packets KD.

Those control data packets KD, which are stored in containers for useful data packets LD, are preferably combined in a subframe whose outer format is adapted to the format of a useful data packet LD, even when the number of current control data packets KD to be transmitted is not sufficient to completely fill the container.

WO 00/49770 provides a detailed description of filling the containers for useful data packets LD with control data packets KD.

ABSTRACT OF THE DISCLOSURE

An identifier is stored within the transmission frame to provide a connection-oriented transmission in a communications system, the identifier indicating the connection to which containers for useful data packets transmitted by a subscriber to the master station belong.

[10191/1964]

A METHOD FOR THE CONNECTION-ORIENTED TRANSMISSION OF DATA PACKETS

Background Information

The present invention starts from a method for transmitting data packets in a communications system in a frame-oriented form between a master station and a plurality of subscribers, useful data packets and control data packets being exchanged between the master station and the subscribers.

In centrally controlled communications networks, e.g. in a centrally controlled wireless cellular network according to the HYPERLAN type 2 ETSI Project, a central unit ZE is provided to which a plurality of terminals can be connected (see Figure 1). This wireless network functions in a connection-oriented manner, i.e., at least one connection must be established before data can be exchanged with other subscribers or their terminals, which are connected to the network or to master station ZE. On the basis of subscriber demands, the master station assigns the terminals the data rate they need on the shared medium. It is possible for one terminal of one subscriber to have more than one active virtual connection at the same time, as is the case with ATM. In an implementation form of this network, the resource requests by the terminals as well as the resource allocations (resource grants) by master station ZE are carried out per connection, i.e., the terminal transmits the amount of data packets that need to be transmitted for each of its connections. Providing data rates during which data can be transmitted on the medium is considered a resource here. Accordingly, master station ZE transmits a resource allocation for each connection of terminal T. In the case of the resource allocation per connection, the assignment of a transmitted data packet to a connection is explicitly provided by the

allocation of master station ZE. Thus, this information is already present in master station ZE and, therefore, does not need to be additionally transmitted by the terminal.

In the aforementioned wireless network, two different data packet sizes are provided for the data to be transmitted. In this context, short packets (approximately 6 bytes; short data container: KD) are used for transmitting control information, i.e., information that is not useful data but is used to control and manage the network, i.e., to establish connections, to associate terminals, to carry out handovers, or to re-request incorrectly received data packets, for example. Long data containers LD have a length of about 54 bytes and are normally used for transmitting useful data. In addition to pure useful data, further information is included that is closely related to the useful data, e.g. a sequence number or a checksum for error detection.

A transmission in the downlink direction (master station toward the subscriber) as well as in the uplink direction (terminal toward master station) includes a plurality of control data packets KD at the beginning and a subsequent plurality of useful data packets LD according to Figure 2. The exact number of control data packets KD and useful data packets LD is determined by master station ZE in the resource allocation.

Summary of the Invention

The measures according to Claim 1 make it possible, particularly in the case of a resource allocation per subscriber or per subscriber terminal, to give the master station preliminary information as to which connection of the subscriber or terminal a received data packet belongs to. This also applies for a resource request or resource allocation per traffic class, as is described in detail in [1] and in the

major points in [2] ([1]: chapter 8.2, DynPara-PDU [2]: chapter 4).

By storing the identifier, which indicates to which connection containers for useful data packets transmitted by the subscriber belong, in the transmission frame, it is possible to clearly identify data packets, which, themselves, do not include any information regarding the connection.

The identifier can advantageously be stored in already existing control data packets. In this manner, the result is a flexible method that does not need to change currently existing data formats. The identifier can also be divided up among a plurality of control data packets.

When containers for useful data packets are each filled with a plurality of control data packets due to a declaration (agreement) between the master station and the subscribers, the method according to the present invention can be easily integrated. The result is a flexible data structure that can be easily integrated in existing or future transmission standards.

The method according to the present invention is particularly advantageous in a communications system in which transmission resources are allocated per subscriber and the subscriber or the subscriber terminal itself selects the useful data packets of different connections.

The application of the method according to the present invention is then particularly useful when a terminal has a large number of connections.

Brief Description of the Drawings

Exemplary embodiments of the present invention are explained in more detail, in light of the additional drawings. The figures show:

Figures 3 and 4 show the structure of the information elements;
Figure 5 shows the allocation of containers for useful data packets to a terminal;
Figures 6 through 13 show formats of further information elements;
Figure 14 shows containers for useful data packets being filled with control data packets.

Description of the Exemplary Embodiments

In the HYPERLAN type 2 communications network indicated at the outset, there are two different types of data containers having different capacities. Data packets having a length of approximately 6 bytes typically contain control information. In the following, they are referred to as control data packets KD. Data packets having a length of about 54 bytes, i.e. having a data capacity of a multiple of the aforementioned data packets, contain, in addition to the useful data, only a short header field containing data belonging directly to the container contents, e.g. sequence number and error correction bits. These data packets are referred to as useful data packets LD in the following. Useful data packets LD and control data packets KD are exchanged between a master station ZE and subscriber terminals T, a frame-oriented transmission being used (Figure 1).

A terminal requests a certain number of useful data packets LD and a certain number of control data packets KD from master station ZE. It is also possible that only useful data packets LD are requested, and control data packets KD are then

automatically provided by master station ZE. This request occurs on the basis of the terminal's internal calculations regarding the needed capacity. Instead, a request per connection or per connection class is also possible. Crucial for the introduced method is only that the information, which relates to which virtual connection a useful data packet LD transmitted from the terminal belongs to, is missing in master station ZE. In the method according to the present invention, this information is transmitted via an identifier CID (connection ID) in an information element IE. Since this information is control information, information element IE is advantageously stored in a control data packet KD within the transmission frame.

These information elements IE contain the information regarding the connection belonging to a useful data packet LD in the form of a connection identity number CID (connection ID). This ID already exists in the HYPERLAN type 2 system. In addition to the connection ID, the number of useful data packets LD for this connection must be transmitted. Another solution that can be used as an alternative or simultaneously is the transmission of the connection ID for every subsequent useful data packet LD, i.e., if a plurality of useful data packets LD belongs to one connection, the connection ID is transmitted several times. The second possibility is particularly suitable for connections having two or less useful data packets LD, since in this case, the field for the number of useful data packets LD is not needed. For the implementation, it is particularly advantageous when both possibilities are available and either one possibility is definitively selected by the terminal at a certain instant, or the terminal selects the most favorable method from case to case, i.e., the method that generates the least amount of data. Both information elements IE then have a fundamental structure, as shown in Figures 3 and 4. The differentiation between the two types of information elements can occur, for example, as a result of different identifiers for information

element IE (IE type) preferably in the header field. However, it is also possible to use the same identifier with an additional qualifier bit.

In the following exemplary embodiment, several parameters are used such that they correspond to the current state of the HYPERLAN type 2 communications network. In this context, two methods are described. The first method includes in each case two fields in information element IE for every active, virtual connection. In this context, the first field includes the identifier of the connection (connection ID), and the second field includes the number of subsequent useful data packets LD for this connection. The second method, on the other hand, only uses fields having connection IDs. In this case, the appropriate connection ID is transmitted for each subsequent useful data packet LD, i.e., when two useful data packets LD are transmitted for one connection, the list also shows the same connection ID twice.

For this example, a centrally controlled communications network having one or more connected terminals is given, as shown in Figure 1. For this example, it is assumed that there is a terminal having 5 virtual connections via master station ZE to the network (connection IDs 1 through 5). For these connections, the terminal transmits a data rate request for all connections. On the basis of this request, master station ZE assigns a certain data set to the terminal. The terminal can now freely use this assigned capacity. Ten allocated useful data packets LD are accepted for the terminal. They are distributed by the terminal in accordance with Figure 5.

In this context, 32 bits are assumed as the smallest unit for a control data packet KD. For this reason, information elements IE should also have a granularity of 32 bits in order to efficiently pack them into a container for control data packets KD. At this point, the 6 bytes indicated above are dispensed with since only the error protection CRC, which is

not important for these considerations, is in the remaining 2 bytes. 6 bits are assumed for the length of the connection ID and also for the field having the number of useful data packets LD. The result is the image shown in Figures 6 and 7 for the information elements according to the first method, i.e., for every connection for which data are transmitted, the connection ID as well as the number of useful data packets LD are transmitted. In this context, the field ID type having a value of 1 indicates that fields are allocated, as previously shown. The length of information element IE indicates how many of the 32 bit units are used (here = 2).

The example according to the second method uses the same fundamental parameters, however, only with 6 allocated useful data packets LD, which are distributed by the terminal in accordance with Figure 8. The result for the entire information element is the arrangement according to Figures 9 and 10. The IE type field having a value of 2 indicates the identification by useful data packet. To be seen is that in this case, in contrast to the first method, there is an efficient implementation of the information transmission provided that only a few useful data packets LD exist per connection.

A combination of the two methods is possible by means of the start of a new information element, which then in each case uses the other method. For this purpose, as an example, one starts out from the distribution of useful data packets LD shown in Figure 11. This total of 13 useful data packets LD can be most efficiently addressed as shown in Figures 12 and 13. An additional possibility is to add a further short field that specifies in each case for two 6-bit fields whether they are used for one connection ID and for the number of useful data packets LD (first method), or for two connection IDs (second method).

In particular in the event that a subscriber or a subscriber terminal T wishes to transmit urgent control information,

terminal T is given the opportunity in accordance with the present invention to fill a container for useful data packets LD with a plurality of control data packets KD. However, for this purpose, information regarding the contents of a subsequent container for useful data must be stored in one control data packet. Moreover, information must be included as to which of the subsequent containers for useful data packets is meant. This is represented by an arrow in Figure 14: a container for useful data packets LD is filled with nine control data packets KD in the transmission frame. However, for this purpose, it must be known to master station ZE that the container is a normal container with useful data. For this purpose, according to the present invention, a declaration is made between master station ZE and a subscriber T that containers for useful data packets LD are filled with control data packets KD that are transmitted together, and it is determined which containers for useful data packets in the transmission frame are filled in each case with control data packets KD. In this context, there are different ways to make this declaration:

1. by a terminal announcing this in a previous control data packet KD. This procedure presupposes an evaluation of control data packets KD prior to the evaluation of useful data packets LD;
2. by announcing the mode in the header field of a useful data packet LD;
3. by transmitting a request by terminal T to master station ZE to be able to fill a container for useful data packets with control data packets;
4. by establishing a firm declaration that starting from a certain number of requests for control data packets KD by a terminal T, a container for useful data packets LD is instead assigned by master station ZE to be filled with control data packets KD.

Those control data packets KD, which are stored in containers for useful data packets LD, are preferably combined in a

subframe whose outer format is adapted to the format of a useful data packet LD, even when the number of current control data packets KD to be transmitted is not sufficient to completely fill the container.

A detailed description of filling the container for useful data packets LD with control data packets KD is described in the application by the same applicant "Verfahren zur effektiven Ausnutzung von Datenpaketen unterschiedlicher Kapazität sowie Zentrale und Teilnehmereinrichtung für ein Kommunikationssystem" (A Method for Effectively Using Data Packets Having Different Capacities as well as a Master station and a Subscriber Device for a Communications System) having the same priority date.

Literature:

1. D. Petras, "Entwicklung und Leistungsbewertung einer ATM-Funkschnittstelle", (Development and Performance Evaluation of a Wireless ATM Interface) Dissertation at the RWTH Aachen, Aachen 1998

2. D. Petras, U. Vornefeld, "Joint Performance of DSA++MAC Protocol for wireless ATM under realistic traffic and channel models" wmATM'98, Hangzhou, China 1998

What is claimed is:

1. A method for transmitting data packets in a communications system in a frame-oriented form between a master station (ZE) and a plurality of subscribers (T), useful data packets (LD) and control data packets (KD) being exchanged between the master station (ZE) and the subscribers (T),
wherein an identifier (CID) is stored within the transmission frame to provide a connection-oriented transmission, the identifier indicating the connection to which one or more containers for useful data packets (LD) transmitted by a subscriber (T) to the master station (ZE) belong.

2. The method as recited in Claim 1,
wherein the identifier (CID) is stored within at least one of the control data packets (KD).

3. The method as recited in Claim 1 or 2,
wherein the identifier (CID) is transmitted in an information element (IE), which includes at least connection identifiers for subsequent containers for useful data packets (LD) of one connection.

4. The method as recited in Claim 3,
wherein the information element (IE) is divided into two types of fields for every active, in particular virtual, connection, i.e., into a first field for connection identifiers (CID) and into a second field for the number of subsequent containers for useful data packets (LD), for the particular connection.

5. The method as recited in Claim 3,
wherein no fields for the number of containers for useful data packets (LD) are stored in the information element (IE), instead, however, one connection identifier (CID)

is provided in the information element (IE), for every container for useful data packets (LD).

6. The method as recited in one of Claims 4 or 5, wherein, in the information element (IE), the type of fields contained is preferably indicated in the header of the information element (ID).

7. The method as recited in one of Claim 3 through 6, wherein a field specifying the length of the information field (IE) is provided in the information element (IE).

8. The method as recited in one of Claims 3 through 7, wherein, in the information element (IE), a field is provided that specifies in each case for two fields provided for connection identifiers or for the number of containers for useful data packets (LD) whether they are intended for a connection identifier and for the number of containers for useful data packets (LD), or are only used for connection identifiers.

9. The method as recited in one of Claims 1 through 8, wherein a connection between the master station (ZE) and subscriber (T) stipulates in each case whether containers for useful data packets (LD) in the transmission frame are filled with a plurality of control data packets (KD).

10. A use as recited in one of Claims 1 through 9 in a communications system in which the transmission resources are allocated per subscriber or per subscriber terminal (T), and the subscriber or the subscriber terminal (T) is able to select the useful data packets (LD) of different connections.

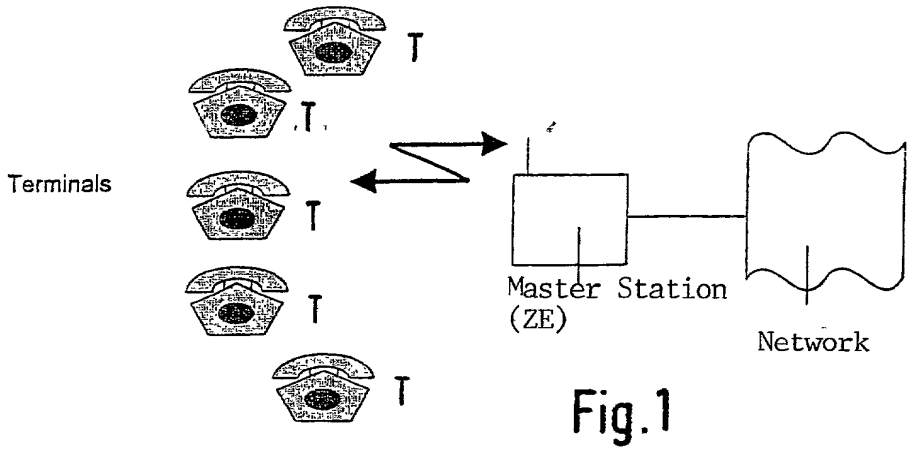

Fig.1

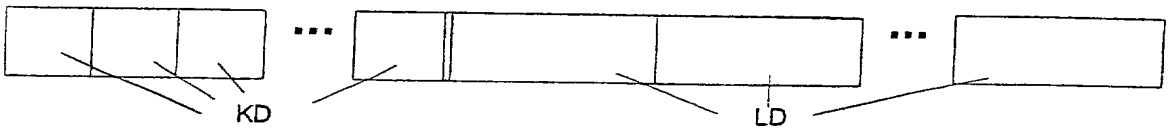

Fig.2

Fig.3

IE Type 1
IE Length
Connection ID 1
Number LD
Connection ID 2
Number LD

Fig.4

IE Type 2
IE Length
Connection ID 1
Connection ID 2
Connection ID 3
Connection ID 3

Connection 1	4 LD
Connection 2	1 LD
Connection 3	2 LD
Connection 4	3 LD
Connection 5	0 LD

Fig.5

Field	Length	Value
IE Type	5 Bits	1
Length of IE	3 Bits	2
Connection ID	6 Bits	1
Number LD	6 Bits	4
Connection ID	6 Bits	2
Number LD	6 Bits	1
	32 Bits	

Fig.6

Field	Length	Value
Connection ID	6 Bits	3
Number ID	6 Bits	2
Connection ID	6 Bits	4
Number LD	6 Bits	3
Empty	8 Bits	X
	32 Bits	

Fig.7

Connection 1	1 LD
Connection 2	1 LD
Connection 3	2 LD
Connection 4	1 LD
Connection 5	1 LD

Fig.8

Field	Length	Value
IE Type	5 Bits	2
Length of the IE	3 Bits	2
Connection ID	6 Bits	1
Connection ID	6 Bits	2
Connection ID	6 Bits	3
Connection ID	6 Bits	3
	32 Bits	

Fig.9

Field	Length	Value
Connection ID	6 Bits	4
Connection ID	6 Bits	5
Connection ID	6 Bits	X
Connection ID	6 Bits	X
Connection ID	6 Bits	X
Empty	2 Bits	X
	32 Bits	

Fig.10

Connection 1	4 LD
Connection 2	5 LD
Connection 3	2 LD
Connection 4	1 LD
Connection 5	1 LD

Fig.11

Field	Length	Value
IE Type	5 Bits	1
Length of the IE	3 Bits	1
Connection ID	6 Bits	1
Number LD	6 Bits	4
Connection ID	6 Bits	2
Number LD	6 Bits	5
	32 Bits	

Fig.12

Field	Length	Value
IE Type	5 Bits	2
Length of the IE	3 Bits	1
Connection ID	6 Bits	3
Connection ID	6 Bits	3
Connection ID	6 Bits	4
Connection ID	6 Bits	5
	32 Bits	

Fig.13

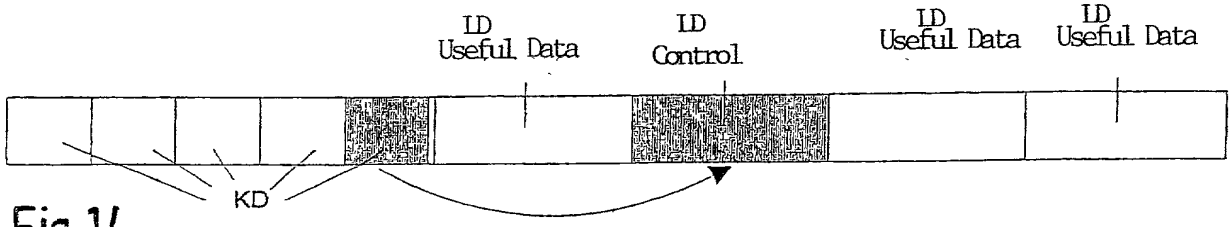

Fig.14

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COMBINED DECLARATION AND
POWER OF ATTORNEY FOR PATENT APPLICATION

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below adjacent to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled **A METHOD FOR THE CONNECTION-ORIENTED TRANSMISSION OF DATA PACKETS**, and the specification of which:

[ ] is attached hereto;

[ ] was filed as United States Application Serial No. _____ on _____, 19__ and was amended by the Preliminary Amendment filed on _____, 19__.

[x] was filed as PCT International Application Number PCT/DE00/00374, on the 8th day of February, 2000

[x] an English translation of which is filed herewith.

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations, §1.56(a). I hereby claim foreign priority benefits under Title 35, United States Code § 119 of any foreign application(s) for patent or inventor's certificate or of any PCT international applications(s) designating at least one country other than the United States of America listed below and have also identified below any foreign application(s) for patent or inventor's certificate or any PCT international application(s) designating at least one country other than the United States of America filed by me on the same subject matter having a filing date before that of the

EL244509764US

application(s) of which priority is claimed:

PRIOR FOREIGN/PCT APPLICATION(S)
AND ANY PRIORITY CLAIMS UNDER 35 U.S.C. § 119

Country : Federal Republic of Germany

Application No. : 199 07 019.9

Date of Filing: 19 February 1999

Priority Claimed
Under 35 U.S.C. § 119 : [x] Yes [ ] No

I hereby claim the benefit under Title 35, United States Code § 120 of any United States Application or PCT International Application designating the United States of America that is/are listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in that/those prior application(s) in the manner provided by the first paragraph of Title 35, United States Code § 112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations § 1.56(a) which occurred between the filing date of the prior application(s) and the national or PCT international filing date of this application:

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PCT INTERNATIONAL APPLICATIONS
DESIGNATING THE U.S. FOR BENEFIT UNDER 35 U.S.C. § 120

U.S. APPLICATIONS

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PCT APPLICATIONS
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PCT Number :

PCT Filing Date :

I hereby appoint the following attorney(s) and/or agents to prosecute the above-identified application and transact all business in the Patent and Trademark Office connected therewith.

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I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment or both under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

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